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Wilma Kooistra

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Abstract

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Wilma Kooistra

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Action Research Report
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Department of Education
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Abstract

The effects of using computer assisted instruction versus a more traditional approach to practice, i.e. flash cards and worksheets, to attain word recognition skills were investigated. A total of 20 students were rated on a pre-test and then assigned to one of two practice groups. The experimental group (10 students) practiced reading skills using Reader Rabbit II, a highly motivational drill and practice software program. The control group (10 students) practiced using worksheets and flash cards. When skills were compared at the end of the testing time, there was shown to be no statistically significant difference between the two modes of practice. However, attitudes of students tend to confirm the value of CAI, and observations indicate that using CAI may be beneficial in serving the needs of lower-achieving students.

The Effects of Computer Assisted Instruction to Teach Word Recognition Skills to Grade Two Students

Since its beginnings in the early 1960's, computer assisted instruction (CAI) has increasingly gained in use and popularity. Schools are currently using computer software programs to supplement or replace more traditional teaching methods in all areas of the curriculum. Many of our Christian schools struggle to have available up-to-date technological tools for their teachers and students. Budgets are stretched to purchase and maintain machines and software. Researchers and educators want to know if the instruction and practice provided by forms of CAI have enhanced educational performance (Feldhusen & Szabo, 1969; Kulik & Kulik 1991; Niemiec & Walberg, 1987). Christian educators must also research its educational value. They especially need to test whether CAI can be instrumental in helping us prepare students for lives of service to God and neighbour.

Much work has been done over the years researching the use of CAI in various disciplines and skill areas. This study will attempt to determine if word recognition skills are best learned using a conventional form of drill and practice, i.e. worksheets and flash cards, or whether drill and practice provided by a computer software program is a more effective way to learn. Focusing on word recognition attainment is an appropriate skill for this study, because learning words requires some measure of drill and practice.

To discover the importance of this question, one must first focus on the significance of learning the skills of word recognition. Although educators have not yet come to consensus over the best method of learning to read (whether it be a top-down or bottom-up approach), there are a number who believe that a balanced reading program that combines the teaching of phonetic skills with the skills of contextual reading is required (Evans & Carr, 1985; Samuels, 1988). Furthermore, several researchers have found that in order to

become a fluent reader, word recognition skills must be both accurate and automatic (Samuels, 1988; Stanovich, 1980). Automaticity is considered to be important because readers have a limited capacity of mental energy or short-term memory required to decode and comprehend what they have read. If too much energy is spent on the decoding process, there will not be enough available for the comprehension process (Breznitz, 1987; Samuels, 1988). Automaticity enables readers to put the majority of their mental energy towards the principal goal of reading: comprehension. Automaticity is typically achieved through practice. In some classrooms this may mean work sheets or flash cards (Lin, Podell & Rein, 1991), but in many classrooms today skills that require repetition are being "drilled and practiced" using various computer software programs.

There are several questions that this study will address. First, will CAI prove to be a better method to practice newly acquired word recognition skills over a more conventional approach? Research indicates that using methods of CAI generally produce positive gains in academic achievement (Heise, Papalewis, & Tanner, 1991; Kulik & Kulik, 1991; Niemiec & Walberg, 1987). In their study, Niemiec and Walberg (1987) critically examined preceding literature reviews in order to synthesize what is known about CAI. They found that typically the use of CAI resulted in a substantial increase in outcome measures. The articles examined expressed the effectiveness of CAI in various ways: enhanced achievement, heightened affective responses, better attitudes, reduced learning time, knowledge retained longer, and skills attained decay less rapidly. According to Vargas (1986), the benefit of using CAI over a traditional approach is its flexibility, its interaction and continuous response, and its inherent individualized instruction based on diagnostic and prescriptive needs.

There are more recent research reports which are a little less enthusiastic about the effects of CAI, yet feel that there is a place for positive application. Lin, Podell, and Rein (1991) report that although students who receive practice using computer instruction are able to demonstrate a quicker response time, the students who receive traditional paper and pencil method demonstrated greater accuracy. They concluded that a logical system for teaching a skill would be to begin with instruction provided by the classroom teacher to

increase accuracy and then to follow with computer instruction to improve response time. Another study relates that CAI is effective as a supplement to traditional teaching (Higgins & Boone, 1993).

Although most research agrees that CAI proves to be beneficial, there are very few studies that show how CAI affects the different ability levels that are present in every classroom. Information in this area would enable teachers to make wise decisions in scheduling computer time based on each child's needs. This leads to a second question that this study will investigate: How are different ability levels, characterized as low, medium, and high, served by CAI? Existing research seems to suggest that students of lower ability reap the greatest benefits from CAI. Higgins and Boone (1993) present and discuss research that has been done within the past decade. Several studies are cited which conclude that CAI instruction is very effective for lower-achieving students. A study by Boone and Higgins (1993) presents information on the use of CAI to provide reading instruction for students in grades K-3. This longitudinal study shows that when broken down into ability groups, the lower-achieving students in the experimental CAI condition consistently achieved significantly higher total test scores than their control peers (Boone & Higgins, 1993). Mancy (1989) speculates that lower-achieving students benefit more from CAI because the highly structured instruction presented by CAI can interfere with the existing learning strategies that high-achieving students have already developed. In contrast, low-achieving students may benefit from a highly structured approach to learning. Another reason that lower-achieving students seem to benefit from CAI may be because of the lack of negative feedback and the infinite patience of the computer (Chan, 1989).

A final question will explore the favoured form of drill and practice: Can computer assisted instruction help to improve student attitudes towards instruction? Watkins (1989) reports that students express better attitudes toward academic work on the computer than toward similar tasks undertaken in a traditional manner. Other studies concur that students respond more favorably to CAI (Feldhusen & Szabo, 1969; Kulik & Kulik, 1987). Computers serve as a motivating factor for students because not only do they allow self-pacing, but they also provide gentle and consistent correction and immediate feedback.

When students are allowed to work at their own pace on a computer, they are able to grasp concepts that may otherwise pose difficulties in a more traditional approach (Lever, Sherrod, Bransford, 1989).

The purpose of this research project is to assess two methods of instruction, one being a form of CAI and the other a more traditional, i.e. worksheets and flash cards, approach in teaching word recognition skills to grade two students. Specifically, what gains will be noted in using a CAI drill and practice approach over a more conventional approach?

If the results of this research provide support that the most effective approach to gaining word recognition skills is through CAI, Christian educators will have to consider another important question. What is a Christian approach concerning responsible use of technology in the classroom? Monsma (1986) warns us that technology is not neutral. It is laden with values. Technology has assumed such a prominance in many people's lives that it has pushed other, often important, aspects out of their lives. The same could be said for the classroom. Choosing to use technology in the classroom will open up some choices for the students just as it precludes others. In the case of this study, CAI may prove to be the most efficient and motivating way to practice word recognition skills, but this may happen at the expense of other important skills such as writing skills and valuable person to person interaction. The key, according to Monsma (1986), is insightful evaluation of technology. Christian educators should be aware of the value-ladenness of technology they bring into the classroom and ask how and why it will be used. On the other hand, we also need to respect technology as part of our culture-forming task which God calls us to as his image bearers. Christian educators should view it as their responsibility to teach and prepare students to be technologically literate, so that even in this area they are equipped to respond obediently to God. In order to be obedient in our use of technology we need to rely on the norms set in God's word. Our perspective on technology needs to be in harmony with our Christian philosophy of education, which values the development of all aspects of the child.

Method

Participants

Twenty students (10 boys and 10 girls) from one second grade class in rural northwest Iowa were participants in the study. Participants were enrolled in a K-8 private school.

Students in the class were matched and randomly assigned to one of two practice conditions according to scores on a pre-test. The pre-test, which consisted of 40 grade-appropriate words compiled by Dr. Edward W. Dolch, was designed to determine word recognition ability. One condition received practice via a computer software program, and the other condition received practice in the form of teacher-constructed worksheets, which covered the same vocabulary and skills as the computer software program.

Participants in each condition were also classified as high, medium, or low achievers according to pre-test scores and by the recommendation of their previous classroom teachers in order to provide opportunity to consider the effects of CAI on students at various achievement levels.

Materials

The pre-test as described above can be found in Appendix A. Students were required to read each word in the word list to the experimenter within a three second time limit as a measure of their present reading ability.

Daily lesson plans were created by the experimenter. They typically consisted of reviewing concepts, introducing new concepts, practicing and checking for understanding. Lessons lasted 15 minutes, allowing for 15 minutes of practice time. See a sample lesson plan in Appendix B.

The software program that was used in the CAI practice condition is Reader Rabbit 2 (Cleland, Armstrong, Margolis & Chin, 1992). This program consists of various word recognition drills such as long and short vowel sounds, beginning and ending consonant

blends, memory skills and more. Appropriate parts of the program that focus specifically on word recognition were chosen by the experimenter. Practice on the computer took place in a computer lab that was equipped with Macintosh computers adequate for the needs of 10 students working in pairs.

Teacher-created worksheets and flash cards were used to represent a traditional method of practice. The material was based on the same vocabulary and skills as the computer software program, but was also a representation of the school's current phonics program. A sample worksheet can be found in Appendix C.

A mastery test was administered at the end of each week to participants in both conditions. These tests, which were cumulative in design, tested the knowledge students gained throughout the testing period. A sample test can be found in Appendix D.

A unit test was administered at the end of the testing period. The unit test was made up of a list of 40 words that followed similar patterns of the vocabulary used throughout the testing period. A copy of this test can be found in Appendix E.

A survey consisting of five simple questions was administered at the completion of the experiment in which students offered their opinions about the preferred method of instruction. The first four questions were based on ones found in a study by Lever et al (1989) that examine the effect of computers on student's attitudes. The last question provided information on past computer exposure and experience. A copy of the survey can be found in Appendix F.

Procedure

The experimenter administered the pre-test to all participants during the week before the classroom instruction and practice occurred. The experimenter tested students individually, asking them to read the words in the word list (Appendix A). The tests were scored by documenting the number of words read correctly out of 40. The criterion for earning a point was to read each word accurately within a three second limit.

According to their pre-test scores, students were matched and randomly assigned to one of two conditions to ensure equivalency of groups. One condition was called a

"traditional practice" group (TPG), and the other a CAI practice group (CPG).

Using their pre-test scores and the recommendation of their previous classroom teachers, students were also sorted according to individual ability within their groups. They were assigned to either a high (top one-third scores), medium (middle one-third scores), or low (bottom one-third scores) ability group. This allowed the researcher to examine the effect of each practice method on the different ability groups.

At the beginning of the testing period, both conditions received instruction from their classroom teacher using the same lesson plans and the same instruction time. Both groups received instruction and practice every day of the week except Friday. Each day consisted of 15 minutes of instruction and 15 minutes of practice. The TPG practiced each day using work sheets and/or flash cards while the CPG was taken to the computer lab for 15 minutes of practice using Reader Rabbit 2. All worksheets were collected and graded by the classroom teacher. The researcher was responsible for monitoring students in the computer lab.

On Friday of each week students were administered a weekly mastery test that covered all material that they had learned that week. The paper and pencil tests were created by the experimenter and were based on the materials and skills the participants had learned and practiced. The tests were administered to both conditions simultaneously. The tests were cumulative, which means that tests of the second and third week covered all the material learned throughout the three week testing period. The researcher evaluated and documented the scores of the tests as the number correct out of the total.

At the end of the testing period, the end-of-unit test was administered to all participants individually. Using the results of this test the researcher was able to evaluate the difference in scores between the two conditions and between the ability groups as well as the improvement of each individual. Similar to the pre-test, each student was asked to read the list of 40 words which followed similar patterns of the words they had learned throughout the testing period. The number of words read correctly (within the three second time allotment) out of 40 was calculated and recorded.

After the testing period, all participants were asked to complete the attitude survey.

The survey results were coded and documented.

Results

A t-test was used to compare the subjects' pre-test and post-test scores. In addition, t-tests were used to compare mean scores on tests 1,2, and 3. The results are summarized in Table 1. No significant results were found for any of the TPG and CPG comparisons.

A t-test was used to analyze the mean attitude scores for TPG and CPG groups. The results of this t-test is summarized in Table 2. No significant difference was found.

Discussion

Results of this research project found no statistical significance between the two modes of practice. Using a computer software program to practice phonetic skills is not necessarily a more effective approach to gaining word recognition skills. Students in the traditional practice group progressed in the skill areas as effectively as did those in the computer practice group.

Results of this research indicate that schools with no access to a computer lab should not feel that they are producing less effective readers when considering word recognition skills. Teacher-made work sheets and flash cards are shown to be just as effective and may in some cases be more beneficial. Work sheets enable teachers to monitor specific areas that may need to be retaught or reviewed, or are able to detect specific needs of individual students. This was noted when papers were graded; the teacher could see errors that were made and identify areas or individuals needing extra practice. Although the software program recorded the scores of each student it did not specify problem areas.

Using a computer software program to practice, these phonetic skills may not be worth the down-time involved in setting up the lab, installing software, and instructing students how to use the program. This time is taken away from either teacher preparation time or from student practice time.

Schools that are looking to install or update computer labs or purchase more software need to carefully evaluate how they plan to use computers and software programs in ways that will benefit instruction and enhance student learning. Lots of money can be spent on programs that end up being nothing more than an interactive drill and practice worksheet, such as in the case of the Reader Rabbit II. If funding is tight, schools may want to carefully consider if this is priority or if they should be pursuing other types of computer assisted instruction that are designed to enhance learning by creating environments for the learner that might otherwise be impossible to provide in the classroom.

On the other hand, the use of computers to practice phonetic skills may be beneficial for several reasons. The research shows that the use of computers did not hamper student's ability to learn decoding skills. Several positive implications of using computers include: 1) Freeing up teacher time. Once the students were able to work independently with the program, the teacher noticed there was less demand on her. She was free to circle around and observe the students' work and spend one-on-one time with individuals who needed extra help. There were no worksheets to correct, which allowed for more time to be spent planning better lessons and completing other tasks. 2) Motivational factor. The researcher noted that using computers as a tool to practice phonetic skills was a motivational factor in itself. The excitement of a new method of practice kept the students eager and enthusiastic about practicing each day. Students in the TPG showed signs of disappointment in having to practice using worksheets while the CPG went to the computer lab to practice. Using the software program was also more captivating for the students. The researcher did not have to urge students in the CPG to stay on task, but when observing the TPG at work, the researcher noticed that the instructor went from pair to pair offering encouragement to stay on task. The software program Reader Rabbit II is also very motivational. Students were involved in activities such as fishing and mining for crystals as they practiced their skills. Immediate feedback and reinforcement was offered in many different ways such as special music, entertaining character antics, voice recordings, ("That's right!", "That's a word!", or "Try again!"), happy faces, sad faces, etc. 3)

Immediate feedback. With teachers busy providing for individual needs, keeping students on task, etc., it is very difficult to give immediate feedback to each child as they are practicing a skill. Sometimes it is not until the next day, after papers are graded, that a teacher is able to give feedback to the student. By then the skill may need to be retaught. A big benefit to using software programs is that students are given immediate feedback. They are not given the chance to practice a skill inaccurately or fall into incorrect habits. 4) Productivity. Another benefit to using a computer software program to practice reading skills is that students are able to complete a greater amount of practice in the same amount of time as those using worksheets or flash cards. The researcher noticed that while students working on worksheets often had trouble processing 30 words on worksheets in 15 minutes, students using the software program processed far more than that. The reason for this is that students in the CPG simply had to click on the correct word using the mouse. It involved no rewriting or typing. Students in the TPG often had to rewrite words which took time away from practicing the skill.

Although there were too few participants in the study to gain an accurate statistical measure concerning how different ability levels are served by CAI, the researcher made several observations. Lower-achieving students were less likely to show signs of frustration or lack of motivation while working at the computer. Some of the higher-achieving students, although captivated and entertained by the program, seemed less motivated to try their best. From this informal observation the researcher tends to agree with work done by Higgins and Boone (1993) which shows that students of lower ability reap the greatest benefits from CAI. This may be due to the highly structured nature of the drill and practice program as well as the lack of negative feedback and the infinite patience of the computer. This indicates that using CAI may be a practice method that better serves the needs of lower achieving students.

As for the favored form of practice, Table 2 shows that CPG did not rate significantly higher than TPG. However, the mean attitude in the CPG is higher than the TPG. This suggests that if the number of participants were higher, it may have been significant.

As Christian educators we have a responsibility to provide education for literacy in language skills as well as technological skills. We need to prepare children to be leaders in a technological age. According to Adams (1995), technology is something we are called by God to do. Christians should view technology as part of their culture-forming response to God's command to "Be fruitful and increase in number, fill the earth and subdue it" (Genesis 1:28). If we shun it in our schools we are not being faithful to our calling. However, because technology is never neutral, we must also be "diligent in testing the spirits driving our technological activity to see if they are from God" (Adams, 1995). All technological tools and software ought to go through a process of evaluation before being purchased or presented to the students. We need to teach our students that technology is to be used to aid us in lives of service for our Creator. Exposing young children to the tools of technology not only has educational merits, but ultimately may lead them to various technological fields, whether it be science, medicine, art, or journalism, in which they can serve God by bringing healing and restoration to a broken world.

Further research suggested by the study would be to increase the sample size as well as the time frame. The study would produce more accurate and valid information if it drew from a broader sample. Three weeks may not allow sufficient time to reveal accurate trends in the study. The excitement connected with using a new and fresh approach to practice may account for some change in score. Three weeks may not allow for enough time for this effect to wear off. Another factor to consider is that the study does not take into consideration prior experience with computers. Some children who have ready access to computers at home may have an unfair advantage over those who have little experience with computers. Children with prior exposure may easily outperform others in the experimental group causing invalid scores. A limiting factor to the study is the attitude survey. The survey was given after the three week testing period and contained pertinent questions about attitiudes connected with using computers. However, the TPG did not have the same opportunity as the CPG to practice using computers which may have affected the way they responded to the questions on the survey.

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Appendixes

Appendix A

Pre-test

1. always
2. around
3. because
4. been
5. before
6. best
7. both
8. buy
9. call
10. cold
11. does
12. don't
13. fast
14. first
15. five
16. found
17. gave
18. goes
19. green
20. its
21. made
22. many
23. off
24. or
25. pull
26. read
27. right
28. sing
29. sit
30. sleep
31. tell
32. their
33. these
34. those
35. upon
36. us
37. use
38. very
39. wash
40. which

Appendix B

Sample Lesson Plan

Short vowel sounds: a, e, and i Time: 30 minutes

Objectives: The student will be able to

1. discriminate between short a, e, and i sounds by listening to words that contain these sounds.
2. identify and sort words that contain the short a, e, and i sounds.
3. draw pictures of words containing the short a, e, and i sounds.

Teaching Activities:

A. Materials:
   1. list of words containing short a, e, and i sounds
   2. worksheets
   3. sets of vowel cards
   4. drawing paper

B. Introductory Activity:

   Review the alphabet by singing it aloud. Pick out the vowels and write them in big letters on the chalk board. Say them aloud together. Explain that these letters are very important letters that make different sounds.

C. Content:
   1. Write the words apple, ax, and acrobat on the board. Say the words aloud and ask what the beginning sound in these words is.
   2. Write the words can, bat, and fan on the board and say these words aloud. Ask if students can hear the same 'a' sound as in apple, ax, and acrobat.
   3. Explain that short 'a' is one of the sounds the vowel 'a' makes.
   4. Repeat 1-3 substituting words with short e and i sounds.
   5. Hand out a set of vowel cards to each student (only a, e and i vowels). Read the word list containing words that have the short a, e, or i sounds. Ask students to listen carefully to each word and raise the vowel card that represents the word, eg) for the word pet, students would raise the 'e' vowel card.

6. Hand out worksheet that contains three columns, one for short a, one for short e and one for short i. At the bottom of the page put a mix of approximately twelve words containing these sounds. Instruct students to sort the words and write them in the proper columns. (See Appendix C).

7. If there is time remaining ask students to divide a piece of drawing paper into three sections with a pencil and ruler. In one section have them draw pictures of words with the short 'a' sound, in another short 'e' sound and in another short 'i' sound.

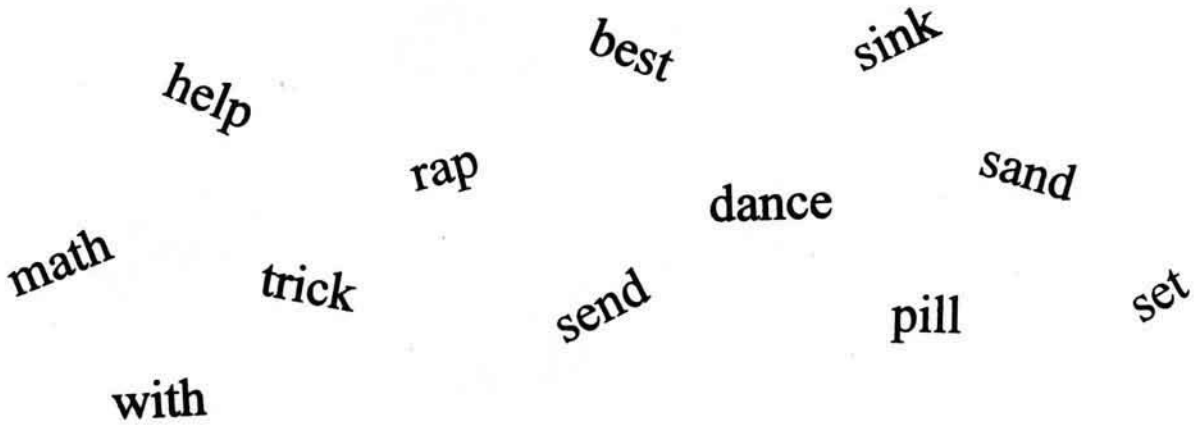
Evaluation:

1. Teacher will check for understanding during activity number 5.
2. Teacher will grade worksheets and check drawings for accuracy.

Appendix C

Worksheet

Short 'a'	Short 'e'	Short 'i'



Appendix D

Sample of Weekly Test

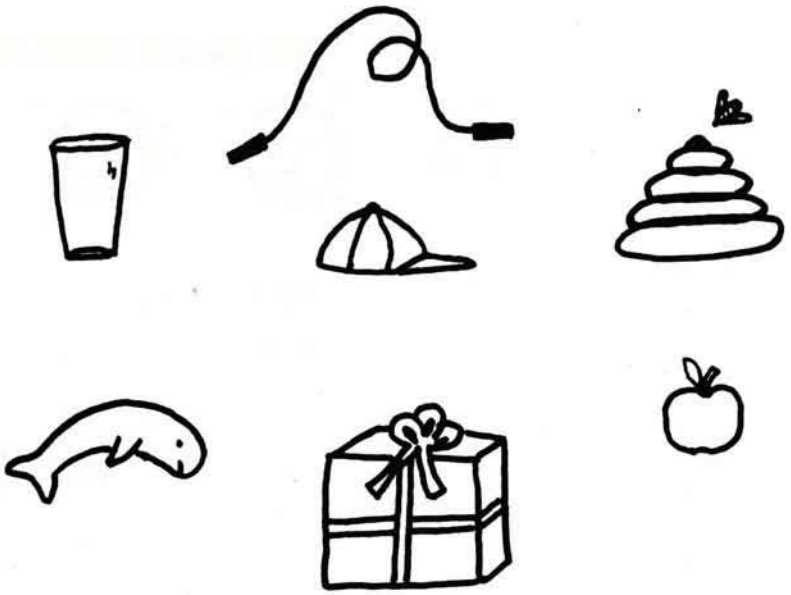
In the following list of words, circle those that have a short vowel sound:

cat	egg	stop
plant	ship	rose
game	brick	shut
pet	bike	lump
keep	joke	use

In the following list of words, circle those that have a long vowel sound:

maze	sell	bone
ham	bike	crop
late	size	cute
free	king	stuck
best	clock	cube

Colour the pictures that have a short vowel sound:



Appendix E

Survey

Colour the face that best answers the question.

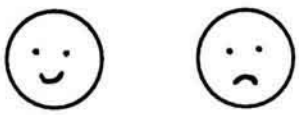
1. Computers make work fun.

2. I learn a lot on a computer.

3. I would rather not use a computer.

4. Computers make me feel:

5. I use a computer at home.



yes no

Appendix F

Unit Test

1. hat
2. elf
3. him
4. job
5. block
6. run
7. stuck
8. grill
9. egg
10. help
11. bread
12. which
13. clock
14. one
15. cake
16. trunk
17. fruit
18. leap
19. peach
20. trade
21. bath
22. desk
23. brick
24. match
25. poke
26. fence
27. long
28. flop
29. trust
30. mole
31. rain
32. toad
33. three
34. mine
35. moon
36. dance
37. cool
38. sheep
39. vote
40. duke

Appendix G

Sioux Center Christian School
630 1st Ave. S.E.
Sioux Center, IA 51250
(712) 722-0777

January 8, 1996

Dear Mr. and Mrs.

I am currently working toward my masters degree at Dordt College. As part of the program I will be conducting an action research project in my classroom using your children as participants in the study. The following information is provided for you to decide whether or not you would like your child to participate. You are free to withdraw your child at anytime.

Your child will be involved in an experiment which will help us determine whether or not it is advantageous to use computer software to practice skills in reading. For the sake of the study, some students will continue to practice using the traditional method of worksheets. Others will practice using a computer software program. Using the information from the study, our school will be able to know what direction we need to take in planning a better reading curriculum.

Your child's participation is strictly voluntary. Your child's name will not in any way be associated with the research findings. The information will be identified with a code number.

If you would like additional information concerning this study, feel free to contact me. Thank you for your cooperation.

Sincerely,

Wilma Kooistra
(712) 722-0806

_____
Signature of parent or legal guardian

Tables

Table 1

Comparison of Performance by Students in Traditional Practice Group Versus Computer Practice Group

Tests	Subjects	X	SD	t-score	Significance
Pre-Test	TPG - 10	34.7	8.757	0.67	.512 (NS)
	CPG - 10	36.8	4.686		
Post-Test	TPG - 10	37.9	2.283	0.36	.720 (NS)
	CPG - 10	38.3	2.627		
Test 1	TPG - 10	27.2	4.756	0.99	.333 (NS)
	CPG - 10	28.8	1.814		
Test 2	TPG - 10	18.1	1.969	0.24	.817 (NS)
	CPG - 10	18.3	1.829		
Test 3	TPG - 10	14.6	2.633	0.7	.496 (NS)
	CPG - 10	15.5	3.136		

Note. CPG = Computer Practice Group. TPG = Traditional Practice Group.

Table 2

Comparison of Attitude by Students in Traditional Practice Group Versus Computer Practice Group

Subjects	X	SD	t-score	Significance
TPG - 10	5	1.247	1.03	0.317
CPG - 10	5.9	2.47		

Note. TPG= Traditional Practice Group. CPG= Computer Practice Group.

Department of Education
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VITA

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